

MOE
DETE
AMGK

c.1
a aa

Copyright Provisions and Restrictions on Copying:

This Ontario Ministry of the Environment work is protected by Crown copyright (unless otherwise indicated), which is held by the Queen's Printer for Ontario. It may be reproduced for non-commercial purposes if credit is given and Crown copyright is acknowledged.

It may not be reproduced, in all or in part, for any commercial purpose except under a licence from the Queen's Printer for Ontario.

For information on reproducing Government of Ontario works, please contact ServiceOntario Publications at copyright@ontario.ca

THE DETERMINATION OF SUSPENDED SOLIDS

Suspended solids pertain to the material which may be removed from a water sample by filtration. The test does not determine specific chemicals - only the general class of substances which have a similar response to the selected test conditions.

Although suspended solids occur naturally from the life cycle, disturbance of fines in river bottoms, and soil leaching by rainwater, they are too frequently caused by man's mis-handling of his environment and industrial activity; to limit the degradation of our water resources, effluents from industrial and waste treatment plants must not contain suspended solids in excess of 15 mg/l. Suspended solids, regardless of origin, have a deleterious effect on many industrial processes; maximum levels in water sources for some manufacturers are 5 mg/l (textile), 10 mg/l (food processing, petroleum refineries, pulp and paper producers), and 15 mg/l (chemical manufacture).

Suspended solids are extremely important in monitoring the operation of a waste treatment plant. The data is required to estimate the loadings applied to aeration tanks and sludge digestors. In treating domestic wastes, an efficient water pollution control plant will reduce the suspended solids from 200 to <15 mg/l.

1. Sample Handling and Preservation

Samples may be collected in glass bottles and preserved by refrigeration; no chemical preservatives may be added. Ideally a suitable volume of sample should be submitted in a separate container for "suspended solids only"; in this way laboratory sampling errors are minimized.

2. Selection of Method

Suspended solids are determined gravimetrically on the non-filterable portion of a sample aliquot.

MOE
DETE
amgk

SUSPENDED SOLIDS
GRAVIMETRIC METHOD

SUMMARY

Substance determined.	The non-filterable residue from a sample aliquot.
Interpretation of results.	Suspended solids are reported in <i>mg/l.</i>
Principle of method.	An aliquot of sample is vacuum filtered through Reeve Angel 934AH fibre glass filter discs. The residue is dried at $103 \pm 2^{\circ}\text{C}$.
Time required for analysis.	2 days. In this period 100 samples can be performed.
Range of application.	Any sample that is filterable under the selected experimental conditions.
Standard deviation.	Rivers and lakes: 0.37 <i>mg/l</i> for range 0 - 20 <i>mg/l</i> . Sewage and trades: 2.07 <i>mg/l</i> for range 0 - 20 <i>mg/l</i> .
Accuracy.	Not applicable.
Limit of detection.	Rivers and lakes: 3.29s = 1.2 <i>mg/l</i> . Sewage and trades: 3.29s = 6.8 <i>mg/l</i> .
Interferences and shortcomings.	Selecting a representative aliquot is the major problem - particularly in sewages where the size of the floc particles varies significantly. Grease and oils, if present, adhere to equipment and affect adversely the drying step.
Minimum volume of sample.	200 ml.
Preservation and sample container.	Samples should be collected in glass bottles and refrigerated but not frozen. Preservatives should not be added.
Safety considerations.	None.

SUSPENDED SOLIDS
GRAVIMETRIC METHOD

1. Introduction

An aliquot of sample is vacuum filtered through pre-washed and pre-weighed Reeve Angel 934AH glass fibre filter papers. The nonfilterable portion is evaporated overnight at $103 \pm 2^{\circ}\text{C}$, and the weight of residue measured on a balance capable of five or six decimal point resolution.

2. Interferences and Shortcomings

Some samples cannot be filtered under the specified experimental conditions while the presence of oils and greases inhibits evaporation to a constant weight. Selecting a representative sample is particularly difficult when the size of particulates varies considerably - the normal state for sewage samples.

3. Apparatus

- a) Reeve Angel 934AH glass fibre filter discs - either 9.0 or 4.25 cm in diameter.
- b) Buchner funnels of appropriate diameter for the filter papers and vacuum filtration unit.
- c) Cylinders, 50 to 500 ml capacity; wide mouth volumetric pipets (25 and 50 ml capacity) for filterable sludges.
- d) Receiving flasks (for filtrate).
- e) Balance - The selected balance must have a minimum resolution of 5 decimal places. A Sartorius 6-place and a Sartorius 5-place are currently used by the River and Sewage laboratories respectively while the electrobalance system is only available in the Sewage laboratory.

The electrobalance system consists of the following modules: 5-place Mettler electrobalance - HE20, digital balance display - Mettler BA28, balance control - Mettler BE20, computer - Hewlett Packard 9810A, typewriter interface - Hewlett Packard 11201A, typewriter - Facit. The computer program is stored on a tape cassette, and listings with other pertinent documentation are filed in the Program Record Book (available from M.W. Rawlings).

The 5-place electrobalance system is preferred to the 5-place Sartorius balance as it improves test precision, reduces errors associated with calculations and record keeping, reduces paper storage requirements, and decreases somewhat the tediousness of multiple weighing.

4. Reagents

None.

5. Procedure

Dissolved and suspended solids are frequently determined concurrently, but the following description only pertains to suspended solids.

- a) Prewash filter papers with distilled water; dry thoroughly in an oven at $103 \pm 2^{\circ}\text{C}$, and cool in a desiccator. Prewashed papers need not be stored in a desiccator. River laboratory normally uses 4.25 cm discs while the Sewage laboratory always uses 9.0 cm discs.
- b) Dust balance interior; level and zero balance. Weigh filter papers designated A and B; ensure A plus B and A minus B values fall within specified limits.
- c) Tare pre-washed and pre-dried filter papers; record weights maintaining order of filter papers. Although any number of samples can be analyzed at a time, samples are usually handled in multiples of 25 - particularly for the electrobalance system.
- d) Select an appropriate aliquot for the sample and record the volume:
 - i) If a sample is submitted in glass bottle designated "for suspended solids only", the entire volume of sample is vacuum filtered. The actual volume in the container is measured using a cylinder; both the sample container and the cylinder are thoroughly rinsed with distilled water and the washings included in the filtration step. This sampling technique was utilized for the Pluarg program where samples were submitted in milk-shaped bottles equipped with plastic snap-on lids; the container capacity was approximately 450 ml.
 - ii) The normal aliquot, for samples submitted for multiple tests, is 200 ml. The volume is measured with a cylinder; the cylinder is then rinsed with approximately 50 ml of distilled water, and the washing included in the vacuum filtration step. (When suspended and dissolved solids are determined concurrently, the aliquot for the dissolved solids test is pipetted before the

washings are added.) The selected aliquot volume may be varied according to the quantity of particulates, but the minimum aliquot is 25 ml (a few sludges) and the maximum is 500 ml (rivers, lakes, or storm sewers).

- e) The filter papers plus nonfilterable matter are dried at $103 \pm 2^{\circ}\text{C}$ overnight. The racks (Sewage laboratory) or perforated plates (River laboratory) of filter papers are cooled, and filter papers weighed as soon as they reach room temperature.
- f) Dust, level, and zero balance. Repeat A - B quality control procedure.
- g) Weigh dried filter papers plus residue, and record weights. The recording is unnecessary for the electrobalance system, but the order of the filter papers must be maintained for both the automated and manual systems.

N.B. Where sample volume permits, analyze at least one out of every 24 samples in duplicate.

Maintenance

- i) Make certain that all glassware, filtration units, filter paper racks and perforated plates are clean and free of oily deposits.
- ii) Keep balance clean at all times. Follow the maintenance procedure outlined in the manufacturer's manual, and keep a record of major overhauls, breakdowns, and "remarks".
- iii) Check balance accuracy every month (weights available from S. Wisz).

6. Calculations and Reporting

$$\text{Suspended Solids (mg/l)} = \frac{(C - D) 10^6}{V}$$

Where C is the weight (g) of the filter paper plus dried nonfilterable material.

D is the weight (g) of the filter paper.

V is the volume (ml) of sample filtered.

Reporting: to the nearest mg/l.

- * If the selected balance (e.g. River laboratory) displays weights in mg, the power index is 3.

7. Precision and Accuracy

The accuracy of suspended solids determinations cannot be estimated as the value obtained depends upon the selected experimental conditions. Precision is estimated by analyzing samples in duplicate:

Suspended Solids Range (mg/l)	Sample Source	Sampling Procedure	# Samples	Standard Deviation (mg/l)
0 - 4	Pluarg	Blind Duplicate	≈60*	0.73
4 - 10		- "S.S. only"	≈60*	0.80
10 - 20		samples	≈60*	0.87
0 - 20	River Lab.	200 ml Aliquots	35	0.37
20 - 50			28	0.53
50 - 100			11	0.59
0 - 20	Sewage Lab.	100 - 200 ml Aliquots	11	2.07
20 - 50			20	2.74
50 - 100			31	3.49
100 - 200			27	5.91
200 - 1000			16	6.53

* Estimated number of samples.

8. Bibliography

- i) *Standard Methods for the Examination of Water and Wastewater*, 14th ed. p89., APHA, Washington, D.C. 1975.
- ii) *Outlines of Analytical Methods*, Ministry of the Environment, Feb. 25, 1975.



(8361)

MOE/DETE/AMGK

	DATE DUE		

MOE/DETE/AMGK

Ontario Ministry of the En

The determination of

suspended solids amgk

c.1 a aa